

III-10.01 Pavement Marking

Markings on highways have important functions to provide guidance and information for road users. Major marking types include pavement, and curb markings, object markings, delineators, colored pavements, barricades, channelizing devices, and islands. They are used to supplement signing and other devices and they are used alone where other devices can't achieve the desired result. Basically, it consists of Long Term and Short Term Markings consisting of Striping and Messages.

III-10.01.1 Pavement Marking Material

Generally, Paint, Epoxies and Preformed Plastic are used for Long Term markings. The Plastic may also be inlaid in Asphalt Pavements or Grooved in PCC Pavements. The type of Pavement Marking to be used may be found in the table, **Pavement Marking Material Selection**, in Appendix III-10 A.

III-10.01.2 Long Term Pavement Marking

Generally, this type marking is covered by Part III of the MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MUTCD). These requirements have been standardized in the following Standards:

1.	Interstate Mainline and Ramps	D-762-2
2.	Rural and Urban two and four lane roads and Interstate.	D-762-4
3.	Flared Intersections	D-762-3
4.	Narrow Bridges	D-754-84
5.	Railroad	D-762-1
6.	Pavement Messages	D-762-1
7.	School Message Part VI of MUTCD and	D-762-1
8.	Left Turn Lane, Stop Bar, and Crosswalk Lines	Typical Detail
9.	Bicycle Lane Markings	Typical Details

These Standard can be found on www.state.nd.us under design division standards.

Note-The Typicals are located in Appendix III-10 B and Appendix III-10 C. The Standards are in the Book of Standards.

III-10.01.3 Short-Term Pavement Marking

Generally, this type pavement Marking is placed in construction zones for up to two (2) weeks.

All Short-Term Pavement Markings , including no-passing zones , should conform to Chapter 3B, 7C, and 9C, Section 8b.16 of the MUTCD and as follows:

- All short-term broken line pavement marking (lane line and center line) of 2-lane 2-way roadways should use the same cycle length as Long Term markings and be 10 foot in length. The cycle length is 40 feet.
- For those short-term situations of 3 calendar days, or less, for 2 or 3 lane roadways, no-passing zones may be identified by using signs rather than pavement markings.
- For Seal and Paving projects with $ADT \leq 750$ short-term pavement marking may be used. In lieu of markings, "No Center Stripe" and "Do Not Pass" signs may be used as shown in D-704-20 type H.

III-10.01.03.1 Paint or Tape Pavement Marking

Short-Term pavement marking paint and beads or pavement marking tape should be applied 4 inches wide and 10 feet in length with an unmarked gap of 30 feet for lane lines and center lines of two lane two way roadways. When required ,no-passing zones should be marked with a 4 inch wide line long enough to cover the no-passing zone with paint or tape.

Short-Term pavement marking should be applied to the roadway for the full length of the surfacing or milled surface before sunset of the same day the work is accomplished.

III-10.01.03.2 Raised Pavement Markers

Raised Pavement Markers (RPMs) may be used without the use of any other pavement markings. When RPMs are used to simulate lines, it is important they are visible day and night. The following guidelines should be applied:

- Lane and Center Lines of two lane, two way roadways– Four (4) RPMs should be used at 3.33 foot centers with a 30 foot gap.
- Solid Lines– The RPMs should be placed on five (5) foot centers to simulate solid lines.
- Double Solid Lines – The RPMs should be placed on five (5) foot centers.

There are three situations where RPMs do not provide adequate simulation of solid lines. When these occur, especially on low speed urban highways, it is necessary to provide these lines with paint or tape. When the existing surface is to be removed , the markings should be painted. Where the existing surface is to remain in place or is the finished surface, the markings should be removable tape.

The three situations are as follows:

- Areas where the RPMs, even at 5 foot centers, become visually separated. This occurs on low speed urban roadways with sharp curves and short transitions. This also occurs where there are steep grades and dips.
- Areas of high ambient lighting which may diminish the retro reflective capabilities of the RPMs.
- Areas where the traffic control will be in place over the winter.

III- 10.01.3.3 Raised Pavement Marker Types

- Type 1- These are acceptable for use on all roadways for short or long term projects. They may be used to simulate solid or broken lines and should be installed and spaced as shown on Standard Drawing D-762-6.
- Type 2 - These markers are acceptable for use where needed for less than 15 calendar days and where the traffic is less than 3,000 ADT They may be used to simulate solid or broken lines as shown on D-762-6.
- Type 3- These are acceptable on chip and sand seal operations. They are designed to be placed prior to beginning seal operations. They have a protective cover that is removed after the application of the seal coat. Generally, these are used to spot the center line by installing at 200 foot centers and marking the beginning and end of the no-passing zones.

III - 10.01.3.4 Seal Coat Projects

Pavement marking should consist of Pavement Marking Paint and Beads. Prior to beginning operations, RPMs should be installed every 200 feet along the center line and at the beginning and end of no-passing zones.

The pavement marking should be in place prior to sunset each day for the full length of roadway that received the seal coat that day as follows:

- Two-Lane Two-Way - The Yellow Broken Center Line should be 4 inches wide and 4 feet long followed by a 36 foot gap.
- Multilane - The White Lane Lines should be 4 inches wide and 4 feet long followed by a 36 foot gap.

- For both types of roadways, the Solid Line Barrier Stripe and No-Passing zones marking should be 4 inches wide for the length to cover the entire barrier line and no-passing zone.

III-10.01.3.5 Edge Lines

Pavement Markings are not required unless there is some circumstance that would suggest they be used. If used they are limited to a duration of 60 days.

III-10.01.3.6 School Zone

Pavement markings are not required if regulations and warnings are conveyed by other devices such as traffic signs, beacons, or signals. If it is determined that school zones can't be adequately protected with these other devices, pavement marking should be installed. Pavement markings are limited to a duration of 60 calendar days except this limit should be no more than 15 calendar days when the Permanent Markings are not installed by August 15.

III-10.01.3.7 Railroad Crossing

Pavement marking is not required, if warning signs and cross bucks are present, unless there are special circumstances. The pavement markings are limited to 60 calendar days.

III-10.01.3.8 Stop Lines

Pavement markings are not required except in locations where it is determined to be important to indicate the point, behind which, vehicles should stop in compliance with Stop Signs or Traffic Signals. These markings are limited to 60 calendar days except this limit will be 15 calendar days if the permanent markings are not installed by September 15.

Markings for Stop Lines for actuated signals may be required because if the stop location is not indicated, there may be erratic signal operation or traffic movements.

III-10.01.3.9 Crosswalks

Crosswalks should be marked at designated non-intersection crossings if such crossings are legally permitted. Markings should be provided at intersections where it is determined that there is substantial conflict between vehicle and pedestrian movements or where there is a need to guide pedestrians in a proper path. Markings may be omitted at locations where the above criteria do not suggest usage. These markings are limited to 60 calendar days.

III-10.01.3.10 Word and Symbol Markings and Channelization Lines

Pavement Markings for these features are not required if regulations, warnings, or guidance are conveyed by other devices. If it is determined that these features are needed they should be installed. The Markings for these features are limited to 60 calendar days.

III-10.01.3.11 No-Passing Zone Markings on State Highway System

No-passing zone shall be marked by either the one direction no-passing zone pavements markings or two-direction no-passing zone pavement markings described and shown in figure III-10.3A and 3B.

When centerline markings are used, no-passing zone markings shall be used on two-way roadways at lane reduction transitions (see figure III-10.3C) and on approaches to obstructions that must be passed on the right (see figure III-10.3D).

Where centerline markings are used, no-passing zone markings shall be used on approaches to highway-rail grade crossings in conformance with Standard Drawing 762-1.

On two-way, two- or three lane roadways, where centerline markings are installed, no-passing zones shall be established at vertical and horizontal curves and other locations where an engineering study indicates that passing must be prohibited because of sight distance or other special conditions.

On three-lane roadways where direction of travel in the center lane transitions from one direction to the other, a no-passing buffer zone shall be provided in the center lane as shown in figure III-10.3E. A lane transition shall be provided at each end of the buffer zone.

The buffer zone shall be a median island that is at least 50 feet in length.

The minimum lane transition taper length shall be 100 feet in urban areas and 200 feet in rural areas.

On roadways with centerline markings, no-passing zones markings shall be used for horizontal or vertical curves where passing sight distance is less than the minimum necessary for reasonably safe passing at the 85th-percentile or the posed or statutory speed limit as shown in table III-10.3F. The passing sight distance on a vertical curve is the distance at which an object 3.5 feet above the pavement surface can be seen from a point 3.5 feet above the pavement (see figure III-10.3G). Similarly, the passing sight distance on a horizontal curve is the distance measured along the centerline (or right-hand lane of a three-lane roadway) between two points 3.5 feet above the pavement on a tangent to the embankment or other obstruction that cuts off the view on inside of the curve (see figure III-10.3G).

Where a segment of highway, with less than 400 feet of adequate sight distance, exists between two no-passing zones, the striping should be continuous from one on-passing zone to the other.

Table III-10.3E

85th- Percentile or Posted or Statutory Speed limit (mph)	Minimum Passing Sight Distance (feet)
25	450
30	500
35	55
40	600
45	700
50	800
55	900
60	1,000
65	1,100
70	1,200

Figure III-10.3A
Two-Lane, Two
Way Marking
Application

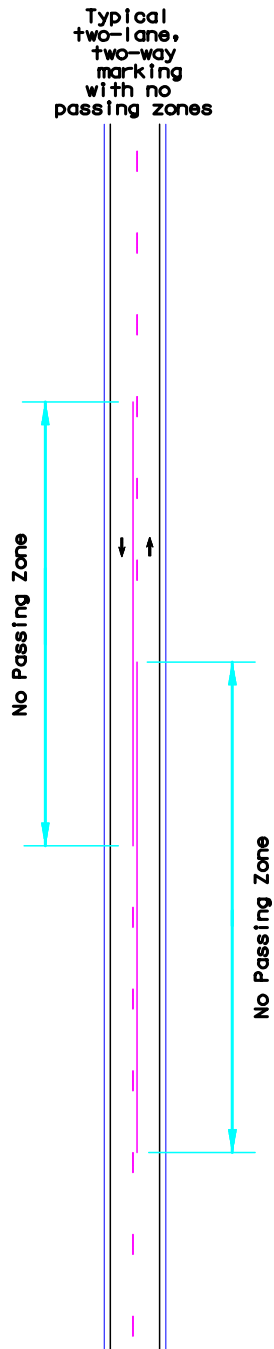
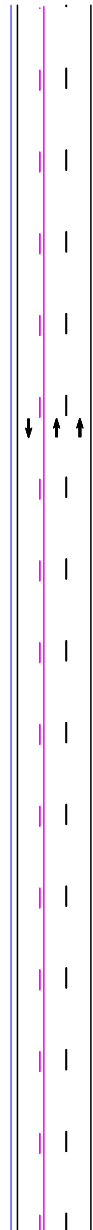


Figure III-10.3B
Examples of Three-Lane,
Two-Way Marking
Application

Typical
three-lane,
two-way
marking
with passing
permitted in
single-lane
direction



Typical
three-lane,
two-way
marking
with passing
permitted in
single-lane
direction

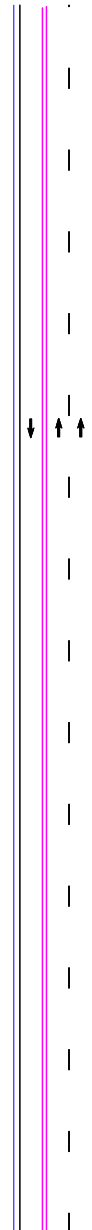


Figure III-10.3C Examples of Lane Reduction Markings

For speeds 45 mph or more
 $L = 0.62 WS$ ($L = WS$)
 For speeds less than 45 mph
 $L = WS^2 / 155$ ($L = WS^2 / 60$)
 S = posted, 85th-percentile, or
 statutory speed in mph
 W = offset distance in ft
 L = length in feet
 d = advance warning distance
 (see Section III-9.04f)

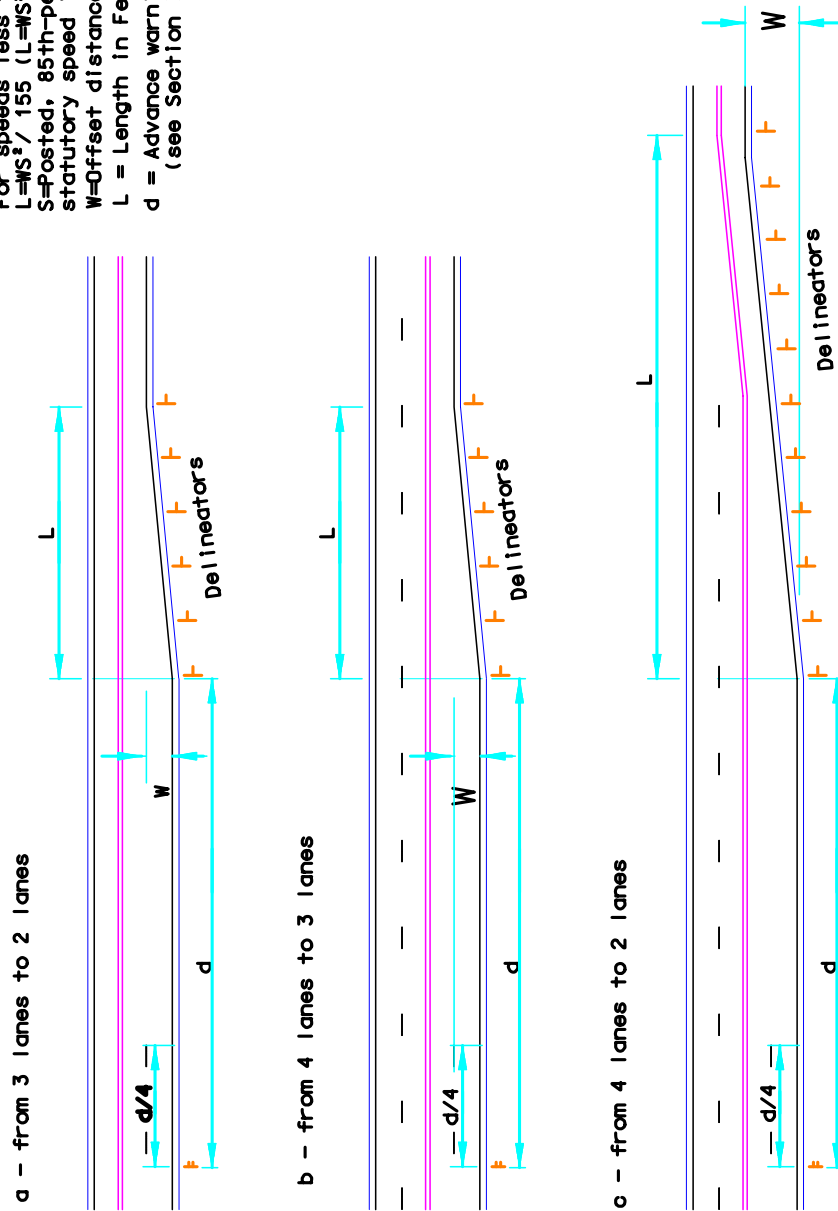
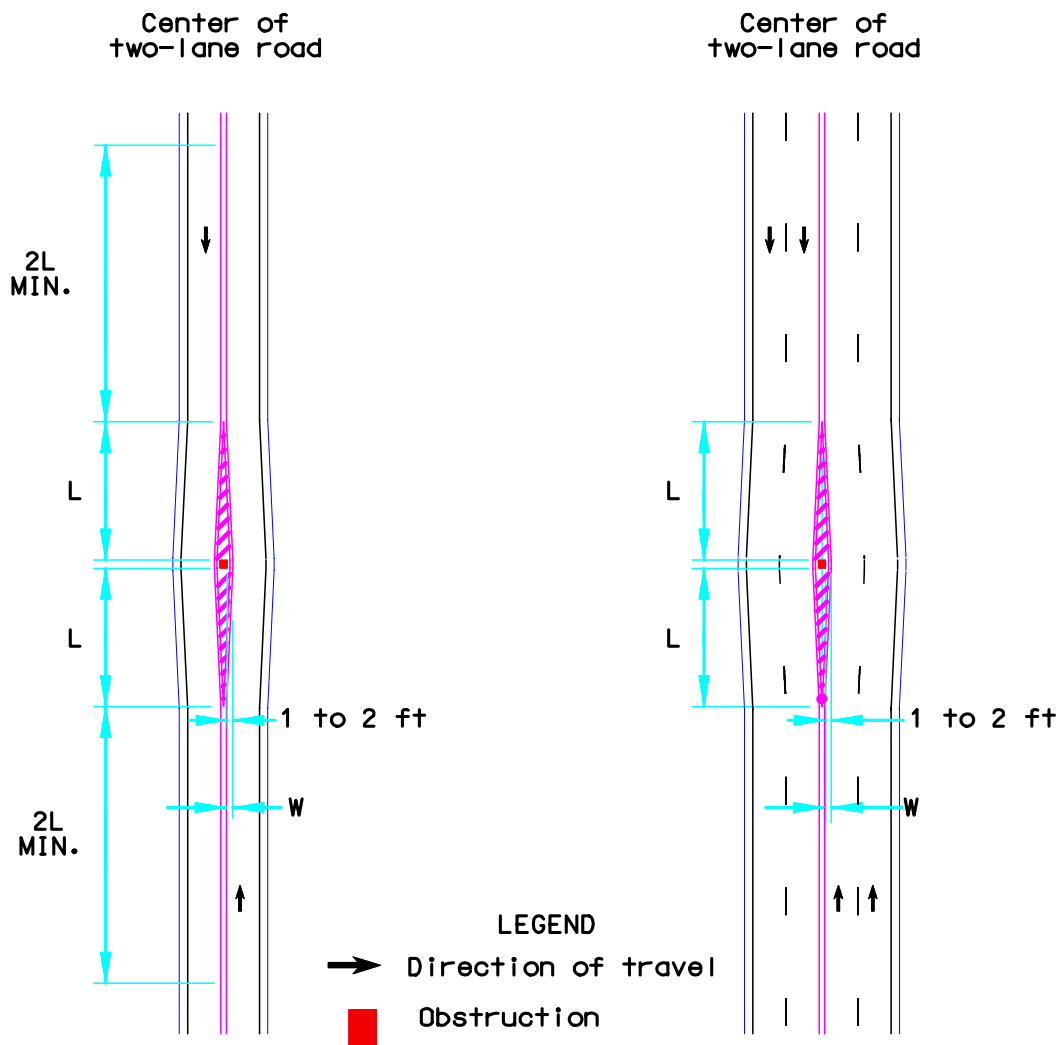


Figure III-10.3D Example of Markings for
Obstructions in the Roadway
(Sheet 1 of 2)



For speeds 45 mph or more $L=0.62 WS$ ($L=WS$)

For speeds less than 45 mph $L=WS^2 / 155$ ($L=WS^2 / 60$)

S=Posted, 85th-percentile, or statutory speed in mph

W=Offset distance in ft

Minimum length of: L= 100 ft in urban areas

L= 200 ft in rural areas

Length "L" should be extended as required by
sight distance conditions.

(Sheet 2 of 2 Legend

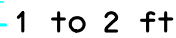


Figure III-10.3E

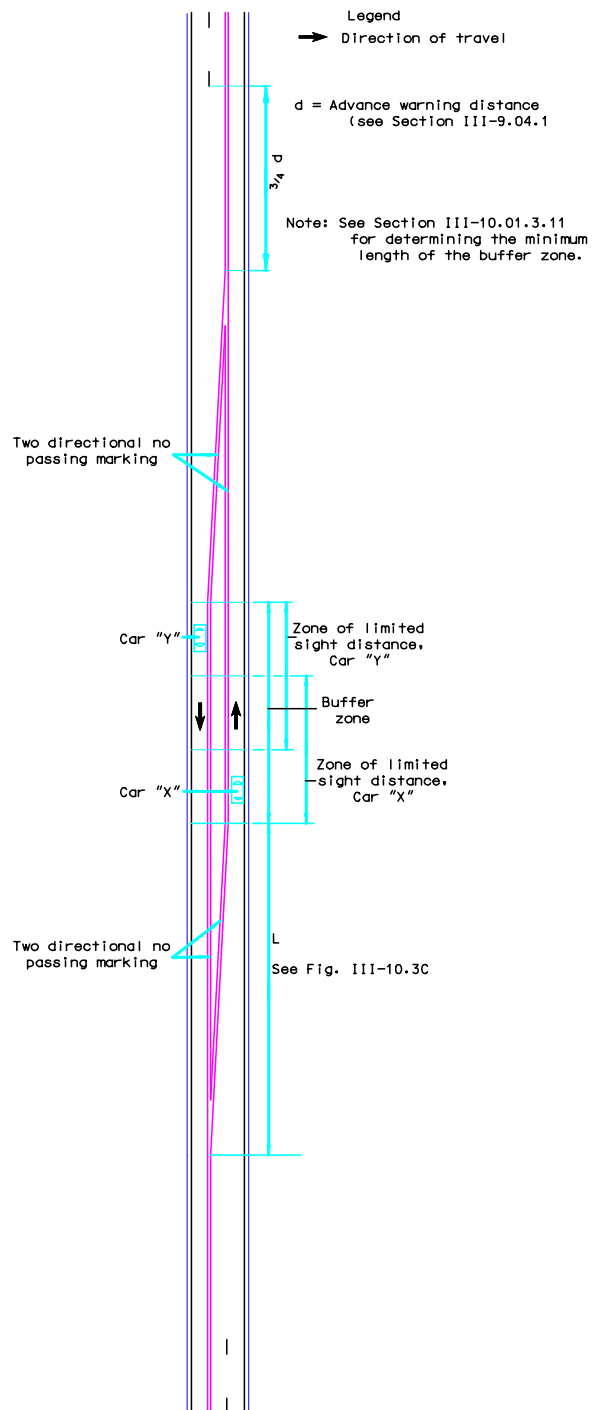
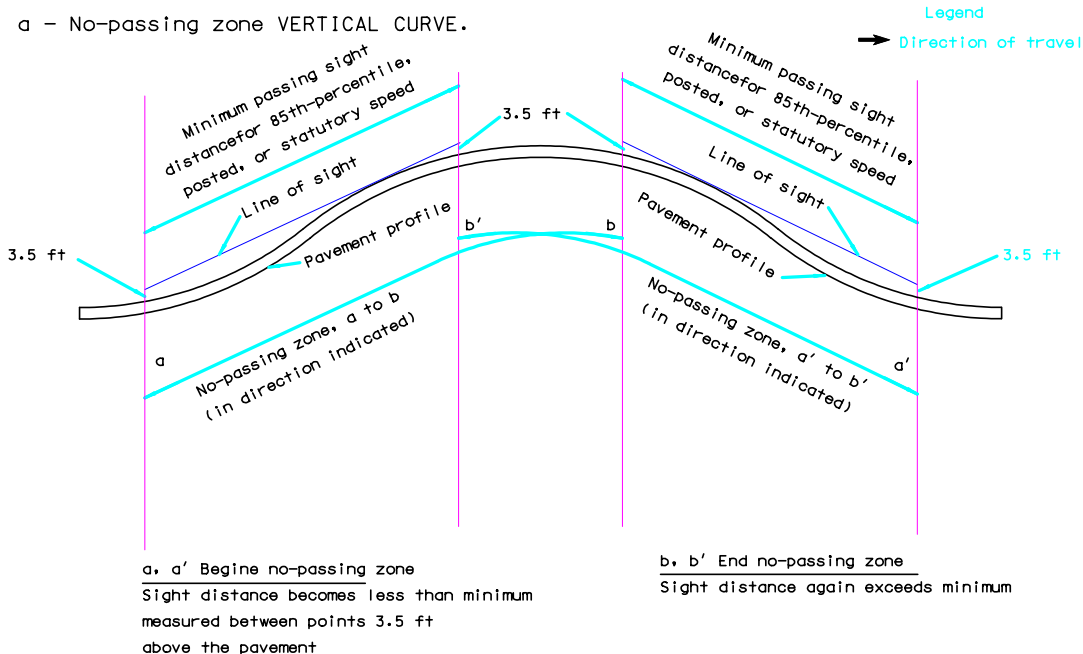


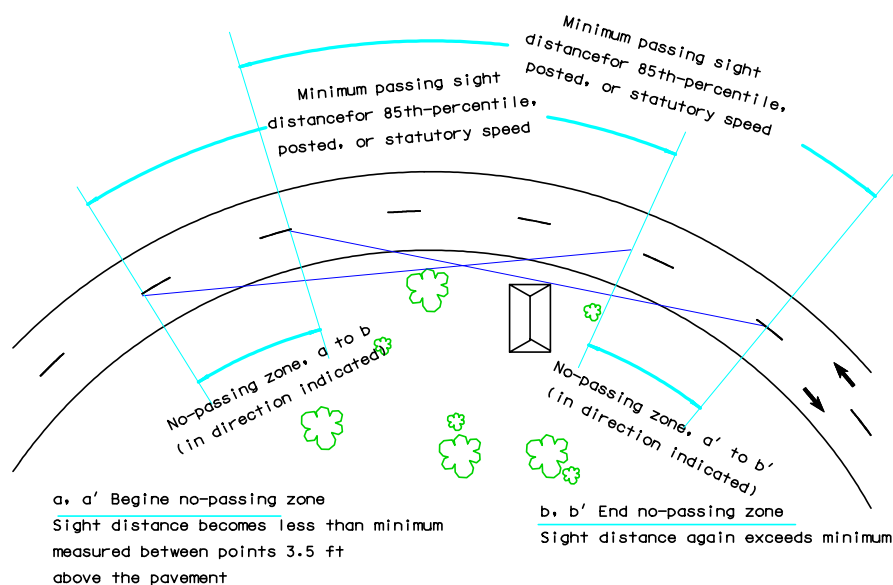
Figure III-10.3F Method of locating and determining the Limits of No-Passing Zones at Curves



PROFILE VIEW

Note: No-passing zones in opposite direction may or may not overlap, dependent on alignment

b - No-passing zone at HORIZONTAL CURVE.



PLAN VIEW

Note: No-passing zones in opposite direction may or may not overlap, dependent on alignment

III-10.02 Delineators

Delineators should be installed along the Interstate, divided highway expressways, interchanges, rest areas, median crossovers, and consideration should also be given to approaches where local roads or county roads intersect a major roadway.

The request to delineate an approach should come from law enforcement and/or Local Government. Residential drives and field drives will not be considered for delineation.

The following conditions should be considered when determining if an approach should be delineated. If any one of the conditions are true, it may warrant delineator installation.

- 1) Crash history with a countermeasure being the installation of delineators.
- 2) Decision sight distance for avoidance maneuver.
 - A. 65 mph, 1050 feet
 - B. 60 mph, 990 feet
 - C. 55 mph, 865 feet
 - D. 50 mph, 750 feet
 - E. 45 mph, 675 feet
 - F. 40 mph, 600 feet

Where the decision sign distance is less than the distances shown, the approach in question should be moved or the addition of a warning sign shall be installed for the intersection along the state highway. Suggested signs to be used may include W2-1 or W2-2, dependent on the type of intersection.

- 3) Engineering judgement.